



Health
Canada
Santé
Canada

Your health and
safety... our priority.

Votre santé et votre
sécurité... notre priorité.

RD2007-07

Registration Decision

Bacillus subtilis strain MBI 600

(publié aussi en français)

2 October 2007

This document is published by the Health Canada Pest Management Regulatory Agency. For further information, please contact:

Publications
Pest Management Regulatory Agency
Health Canada
2720 Riverside Drive
A.L. 6605C
Ottawa, Ontario
K1A 0K9

Internet: pmra_publications@hc-sc.gc.ca
www.pmra-aria.gc.ca
Facsimile: 613-736-3758
Information Service:
1-800-267-6315 or 613-736-3799
pmra_infoserv@hc-sc.gc.ca

Canada

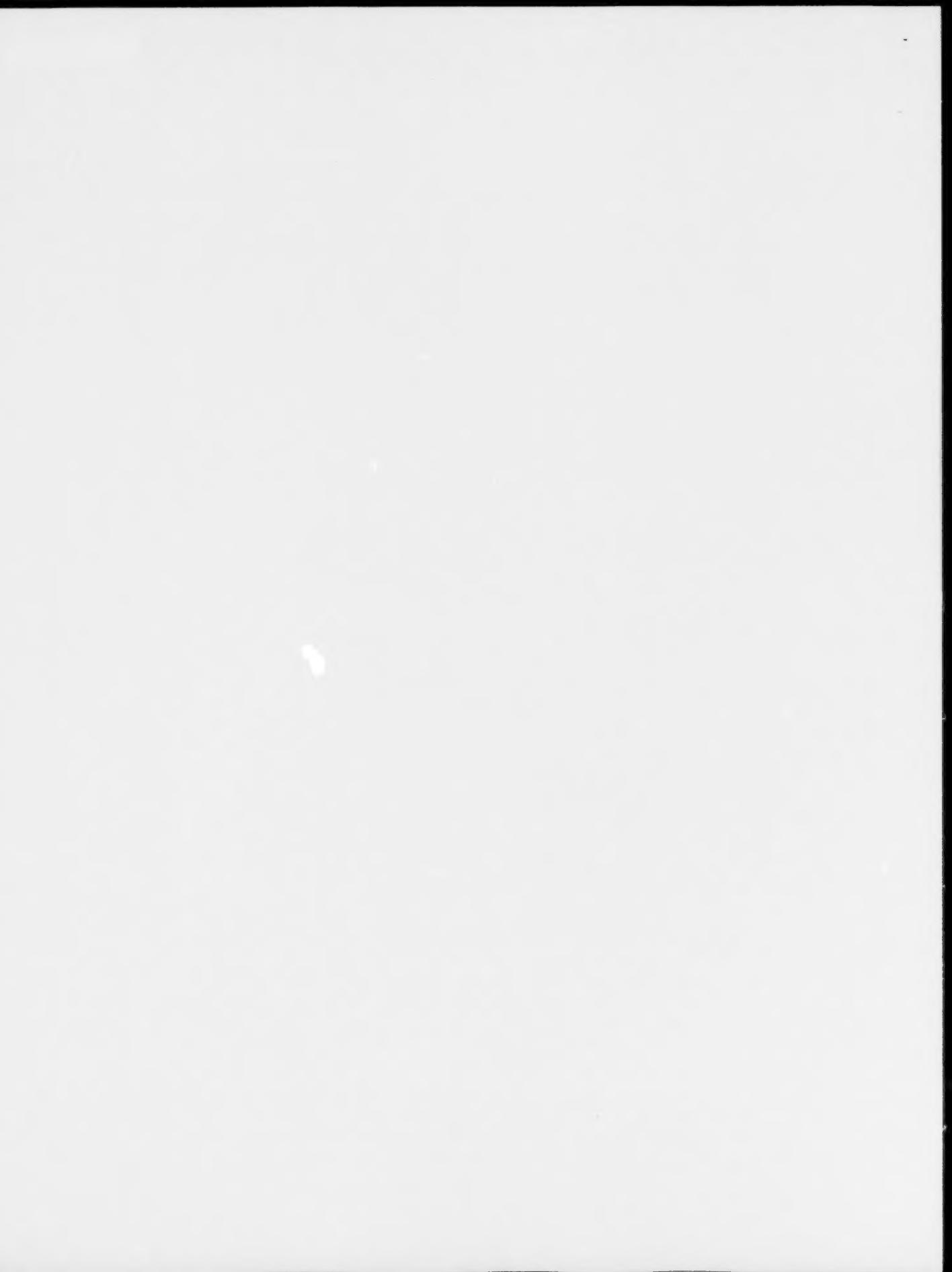
ISBN: 978-0-662-46624-6 (978-0-662-46625-3)
Catalogue number: H113-25/2007-7E (H113-25/2007-7E-PDF)

© Her Majesty the Queen in Right of Canada, represented by the Minister of Health Canada, 2007

All rights reserved. No part of this information (publication or product) may be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, or stored in a retrieval system, without prior written permission of the Minister of Public Works and Government Services Canada, Ottawa, Ontario K1A 0S5.

Table of Contents

Registration Decision for <i>Bacillus subtilis</i> strain MBI 600	1
What Does Health Canada Consider When Making a Registration Decision?	1
What Is Pro-Mix With Biofungicide?	2
Health Considerations	3
Environmental Considerations	4
Value Considerations	5
Measures to Minimize Risk	5
Other Information	6
References	7



Registration Decision for *Bacillus subtilis* strain MBI 600

Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is granting full registration for the sale and use of technical grade active ingredient *Bacillus subtilis* MBI 600 Technical containing the microbial pest control agent *Bacillus subtilis* strain MBI 600, the manufacturing-use product Subtilex™ Biological Fungicide and the end-use products Pro-Mix (HP, BX, PGX and TA) with Biofungicide to suppress damping-off and root-rot diseases caused by *Pythium* spp. on greenhouse vegetables, including transplants and greenhouse ornamentals.

Current scientific data from the registrant, scientific reports and information from other regulatory agencies were evaluated to determine if, under the proposed conditions of use, the product has value and does not present an unacceptable risk to human health or the environment.

These products were first proposed for registration in the consultation document¹: Proposed Registration Decision—*Bacillus subtilis* strain MBI 600 (PRD2007-05). This Registration Decision² describes this stage of the PMRA's regulatory process for *Bacillus subtilis* MBI 600 Technical, the manufacturing-use product Subtilex™ Biological Fungicide and the end-use products Pro-Mix (HP, BX, PGX and TA) with Biofungicide and summarizes the Agency's decision and the reasons for it. The PMRA received no comments on Proposed Registration Decision—*Bacillus subtilis* strain MBI 600 (PRD2007-05) that would impact the risk assessment. This decision is consistent with the proposed registration decision stated in Proposed Registration Decision—*Bacillus subtilis* strain MBI 600 (PRD2007-05).

For more details on the information presented in this Registration Decision, please refer to the Science Evaluation section of the related Proposed Registration Decision—*Bacillus subtilis* strain MBI 600 (PRD2007-05).

What Does Health Canada Consider When Making a Registration Decision?

The key objective of the *Pest Control Products Act* is to prevent unacceptable risks to people and the environment from the use of pest control products. Health or environmental risk is considered acceptable if there is reasonable certainty that no harm to human health, future generations or the

¹ "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

² "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

environment will result from use or exposure to the product under its conditions or proposed conditions of registration³. The Act also requires that products have value⁴ when used according to label directions. Conditions of registration may include special precautionary measures on the product label to further reduce risk.

To reach its decisions, the PMRA applies modern, rigorous risk assessment methods and policies. These methods consider the unique characteristics of sensitive subpopulations in humans (e.g. children) as well as organisms in the environment (e.g. those most sensitive to environmental contaminants). These methods and policies also consider the nature of the effects observed and the uncertainties present when predicting the impact of pesticides. For more information on how the PMRA regulates pesticides, the assessment process and risk-reduction programs, please visit the PMRA's website at www.pmra-ara.gc.ca.

What Is Pro-Mix With Biofungicide?

The four Pro-Mix with Biofungicide end-use products (HP, BX, PGX and TA) are peat-based soilless growing media that contain the biological pesticide, *Bacillus subtilis* strain MBI 600. *Bacillus subtilis* strain MBI 600 is a naturally occurring bacterium that rapidly colonizes the roots of growing plants and produces an antibiotic protein that suppresses the ability of *Pythium* spp. to grow and reach levels necessary to trigger damping-off or root-rot diseases. The four products are formulated for different uses by greenhouse growers.

Pro-Mix BX with Biofungicide is a general purpose peat-based professional growing medium designed for the cultivation of a wide variety of horticultural plants including vegetable transplants.

Pro-Mix HP with Biofungicide is a highly porous peat-based professional growing medium designed for the cultivation of a wide variety of horticultural plants including water sensitive crops, the propagation of plant cuttings and/or use in low-light conditions.

Pro-Mix PGX with Biofungicide is a peat-based professional growing medium designed for the germination of ornamental and vegetable seeds with plug systems.

Pro-Mix TA with Biofungicide is a general purpose peat-based professional growing medium designed for the germination and growth of tobacco as well as other vegetable and ornamental transplants.

³ "Acceptable risks" as defined by subsection 2(2) of *Pest Control Products Act*.

⁴ "Value" as defined by subsection 2(1) of *Pest Control Products Act*: "...the product's actual or potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (a) efficacy; (b) effect on host organisms in connection with which it is intended to be used; and c) health, safety and environmental benefits and social and economic impact".

Health Considerations

Can Approved Uses of Pro-Mix with Biofungicide Affect Human Health?

***Bacillus subtilis* strain MBI 600 is unlikely to affect your health when Pro-Mix with Biofungicide is used according to the label directions.**

Exposure to *Bacillus subtilis* strain MBI 600 may occur during handling of Pro-Mix with Biofungicide (soilless growing media). When assessing health risks, several key factors are considered: the microorganism's biological properties (e.g. production of toxic byproducts), reports of any adverse incidents; its potential to cause disease or toxicity as determined in toxicological studies and the likely levels to which people may be exposed relative to exposures already encountered in nature to other strains of the microorganism. Toxicology studies in laboratory animals describe potential health effects from large doses in hopes of identifying any potential to cause disease or toxicity. No significant toxicity and no signs of causing diseases were observed when *Bacillus subtilis* strain MBI 600 was tested on laboratory animals.

Residues in Water and Food

Dietary risks from food and water are not of concern.

The *Food and Drugs Act* prohibits the sale of adulterated food, that is, food containing a pesticide residue that exceeds the established maximum residue limit (MRL). Pesticide MRLs are established for *Food and Drugs Act* purposes through the evaluation of scientific data under the *Pest Control Products Act*. Each MRL value defines the maximum concentration in parts per million (ppm) of a pesticide allowed in/on certain foods. Food containing a pesticide residue that does not exceed the established MRL does not pose an unacceptable health risk.

Bacillus subtilis strains are common in nature and the use of Pro-Mix with Biofungicide as growing medium for plants is not expected to significantly increase the natural environmental background levels of this microorganism. Few, if any, bacteria are expected to remain as residues on plants at harvest because *Bacillus subtilis* strain MBI 600 is present in the plant's growing medium. Some strains of *Bacillus subtilis* have been isolated from food samples implicated in food poisoning; however, these strains demonstrated the ability to produce a highly heat-stable toxin that may be similar to a toxin produced by *Bacillus cereus*, a known food borne pathogenic microorganism. *Bacillus subtilis* strain MBI 600 is not reported to produce this toxin. Also, no such effects were reported for this microorganism in the United States where it has been registered since 1994. Furthermore, there was no significant toxicity and no signs of causing diseases were observed when *Bacillus subtilis* strain MBI 600 was administered orally to rats. The establishment of an MRL is therefore not required for *Bacillus subtilis* strain MBI 600. Furthermore, the likelihood of residues of *Bacillus subtilis* strain MBI

600 contaminating drinking water supplies is negligible to non-existent. Consequently, dietary exposure and risk are minimal to non-existent.

Occupational Risks From Handling Pro-Mix With Biofungicide

Occupational risks are not of concern when Pro-Mix with Biofungicide is used according to the label directions, which include protective measures.

Growers handling Pro-Mix with Biofungicide can come into direct contact with *Bacillus subtilis* strain MBI 600 on the skin, in the eyes or by inhalation. For this reason, the label specifies that growers exposed to Pro-Mix with Biofungicide must wear waterproof gloves, a long-sleeved shirt, long pants, shoes and socks. Handlers must also wear a dust-filtering mask and eye goggles when opening bags of product and/or filling potting machines. Furthermore, early-entry workers will be restricted from entering areas where dry Pro-Mix with Biofungicide was handled for a period of up to four hours unless wearing the appropriate personal protective equipment.

For bystanders, exposure is expected to be much less than that of handlers and mixer/loaders and is considered negligible. Therefore, health risks to bystanders are not of concern.

Environmental Considerations

What Happens When Pro-Mix with Biofungicide Is Introduced Into the Environment?

Environmental risks are not of concern.

In published literature, other strains of *Bacillus subtilis* have been reported to cause infections in mammals, terrestrial insects and plants. However, these reports were few in number despite the large amount of published literature on this microorganism and either involved unusual strains or the ability of the select strain of *Bacillus subtilis* to cause disease was not thoroughly investigated. There are no published reports of disease associated with *Bacillus subtilis* in birds, earthworms, bees, aquatic invertebrates, fish, algae and aquatic plants. *Bacillus subtilis* is not generally considered to be a disease causing agent. Therefore, Pro-Mix with Biofungicide is expected to present a negligible risk to non-target organisms.

Value Considerations

What Is the Value of Pro-Mix With Biofungicide?

The four Pro-Mix with Biofungicide end-use products suppress damping-off and root-rot diseases caused by *Pythium* spp. on greenhouse crops. The use of these products as seeding or planting media will replace the first preventative fungicide application; thus, it may reduce the number of applications of chemical fungicides. This reduction in the number of applications could decrease the possibility of pathogens developing resistance to traditional chemical-based fungicides. These four end-use products can also potentially enhance the adoption of reduced-risk technologies by producers because they are ready for immediate use, have a long shelf-life (up to 24 months) and offer few risks to human health and the environment.

Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law.

The key risk-reduction measures on the label of Pro-Mix with Biofungicide to address the potential risks are as follows.

- Human Health**

Because of concerns with toxicity via the pulmonary route and with users developing allergic reactions through repeated high exposures to *Bacillus subtilis* strain MBI 600, anyone handling Pro-Mix with Biofungicide must wear waterproof gloves, long-sleeved shirt, long pants and shoes plus socks. A dust/mist-filtering mask must also be worn when opening bags and/or filling potting machines. Furthermore, early-entry workers will be restricted from entering areas where dry Pro-Mix with Biofungicide was handled for a period of up to four hours unless wearing the appropriate personal protective equipment.

- Environment**

As a general precaution, handlers are asked to not contaminate irrigation or drinking water or aquatic habitats by cleaning of equipment or by disposing of wastes. In addition, growers must not allow effluent or runoff from greenhouses containing this product to enter lakes, streams, ponds or other water bodies.

Other Information

The relevant test data on which the decision is based (as referenced in this document) are available for public inspection, upon application, in the PMRA's Reading Room (located in Ottawa). For more information, please contact the PMRA's Pest Management Information Service by phone (1-800-267-6315) or by e-mail (pmra_infoserv@hc-sc.gc.ca).

Any person may file a notice of objection⁵ regarding this registration decision on *Bacillus subtilis* strain MBI 600 within 60 days from the date of publication of this Registration Decision Document. For more information regarding the basis for objecting (which must be based on scientific grounds), please refer to the PMRA's website (Request a Reconsideration of Decision, www.pmra-arl.gc.ca/english/pubreg/reconsideration-e.html) or contact the PMRA's Pest Management Information Service by phone (1-800-267-6315) or by e-mail (pmra_infoserv@hc-sc.gc.ca).

⁵ As per subsection 35(1) of the Pest Control Products Act (<http://laws.justice.gc.ca/en/P-9.01/92455.html>).

References

A. LIST OF STUDIES/INFORMATION SUBMITTED BY REGISTRANT

1.0 THE ACTIVE INGREDIENT, ITS PROPERTIES AND USES

PMRA 1099752 Product profile and proposed use pattern *Bacillus subtilis* MBI 600 Technical. Premier Horticulture. 2005. DACO: M1.2

PMRA 1099753 International Regulatory Status of the *Bacillus subtilis* MBI 600 Technical. Premier Horticulture. 2005. DACO: M1.3

PMRA 1098379 Product profile and proposed use pattern Subtilex™ Biological Fungicide. Premier Horticulture. 2005. DACO: M1.2

PMRA 1098380 International Regulatory Status Subtilex™ Biological Fungicide. Premier Horticulture. 2005. DACO: M1.3

PMRA 1098404 Product profile and proposed use pattern PRO-MIX HP with Biofungicide. Premier Horticulture. 2005. DACO: M1.2

PMRA 1098405 International Regulatory Status PRO-MIX HP with Biofungicide. Premier Horticulture. 2005. DACO: M1.3

PMRA 1098448 Product profile and proposed use pattern PRO-MIX BX with Biofungicide. Premier Horticulture. 2005. DACO: M1.2

PMRA 1098449 International Regulatory Status PRO-MIX BX with Biofungicide. Premier Horticulture. 2005. DACO: M1.3

PMRA 1098505 Product profile and proposed use pattern PRO-MIX PGX with Biofungicide. Premier Horticulture. 2005. DACO: M1.2

PMRA 1098506 International Regulatory Status PRO-MIX PGX with Biofungicide. Premier Horticulture. 2005. DACO: M1.3

PMRA 1098550 Product profile and proposed use pattern PRO-MIX TA with Biofungicide. Premier Horticulture. 2005. DACO: M1.2

PMRA 1098551 International Regulatory Status PRO-MIX TA with Biofungicide. Premier Horticulture. 2005. DACO: M1.3

2.0 METHODS OF ANALYSIS

PMRA 1099756 Product Characterization and Analysis table. Premier Horticulture. 2005. DACO: M2.1,M2.2,M2.3,M2.4,M2.5,M9.7

PMRA 1099758 Analysis for microbial contaminants. Premier Horticulture. 2005. DACO: M2.10.2

PMRA 1099759 Analysis for Microbial Contaminant. Premier Horticulture. 2005. DACO: M2.10.3

PMRA 1099760 Stability/Shelf-Life Evaluation of Subtilex. 2005. DACO: M2.11

PMRA 1099761 Summary of Physical and Chemical Properties. Premier Horticulture. 2005. DACO: M2.12

PMRA 1099762 Canadian Patent Database Patent: CA 1324099 and 1337935, Canadian Intellectual Property Office. 1993. DACO: M2.6

PMRA 1099763 Results of API test Kit. 2004. DACO: M2.7.1

PMRA 1099764 Reconnaître la souche de *Bacillus subtilis* MBI 600 parmi différentes souches de *Bacillus* sp. Premier Horticulture. 2005. DACO: M2.7.1

PMRA 1099765 Origin, derivation and identification MPCA *Bacillus subtilis* MBI 600 Technical. Premier Horticulture. 2005. DACO: M2.7.1

PMRA 1099766 Confirmation of Strain Discovery Letter. 2004. DACO: M2.7.1

PMRA 1099767 Biological Properties of the MPCA. Premier Horticulture. 2005. DACO: M2.7.2

PMRA 1099768 Review of literature on occurrence and persistence of the bacterium *Bacillus subtilis* (1999-2005). Premier Horticulture. 2005. DACO: M2.7.2

PMRA 1099771 Review of literature on occurrence and persistence of the bacterium *Bacillus subtilis*. The MicroBio Group Ltd. 1999. DACO: M2.7.2

PMRA 1099773 Manufacturing methods and quality assurance. Premier Horticulture. 2005. DACO: M2.8,M2.9.2

PMRA 1099774 Product Chemistry Data, GUS 376 Concentrate Biological Fungicide. Gustafson. 1993. DACO: M2.8,M2.9.2

PMRA 1099775	Product specifications. Premier Horticulture. 2005. DACO: M2.9.1
PMRA 1099777	Disclosure of Ingredients. Premier Horticulture. 2005. DACO: M2.9.3
PMRA 1100204	Standard Operating procedures for the QC and QA of Becker Underwood's <i>Bacillus subtilis</i> (MBI 600) Products. Gustafson. DACO: M2.8
PMRA 1290506	Centre d'expertise en analyse environnementale du Québec. Method ILMA-004: Méthode d'analyse Recherche et dénombrement de <i>Staphylococcus aureus</i> : méthode par filtration sur membrane. DACO: M2.10
PMRA 1290520	Methods ILME-8, ILME-4, ILME-31, ILME-28, USP 27 and ILCE-030. DACO: M2.10
PMRA 1290521	Additional Information for DACO M2.11 - Storage Stability. 2006. DACO: M2.10
PMRA 1303381	Préparation d'un milieu de culture, PHL-LA-WI-090. 2002. DACO: M2.8
PMRA 1303387	Méthode d'analyse. Recherche et dénombrement de <i>Straphylococcus aureus</i> méthode par filtration sur membrane, MA.700-STA 1.0. 2005. DACO: M2.8
PMRA 1098381	Product Characterization and Analysis. Premier Horticulture. 2005. DACO: M2.1,M2.2,M2.3,M2.4,M2.5,M2.6
PMRA 1098382	Analysis for Other Unintentional Ingredients. Premier Horticulture. 2005. DACO: M2.10.3
PMRA 1098383	Stability/Shelf-Life Evaluation of Subtilex. 2005. DACO: M2.11
PMRA 1098384	Summary of Physical and Chemical Properties. Premier Horticulture. 2005. DACO: M2.12
PMRA 1098385	Production of Subtilex™ Biological Fungicide. Premier Horticulture. 2005. DACO: M2.8
PMRA 1098386	Product Specification Form. Premier Horticulture. 2005. DACO: M2.9.1
PMRA 1098387	Disclosure of Ingredients. Premier Horticulture. 2005. DACO: M2.9.3

PMRA 1098406	Product Characterization and Analysis table. Premier Horticulture. 2005. DACO: M2.1,M2.2,M2.3,M2.4,M2.5,M2.6
PMRA 1098407	Analysis for Other Unintentional Ingredients for Pro-Mix HP with Biofungicide. Premier Horticulture. 2005. DACO: M2.10.3
PMRA 1098408	Storage stability results for PRO-MIX HP with Biofungicide. Premier Horticulture. 2005. DACO: M2.11
PMRA 1098409	Product specifications form and formulants MSDS, Premier Horticulture. 2005. DACO: M2.9.1
PMRA 1098418	Waiver requested for contaminants screening results for PRO-MIX HP with Biofungicide. Premier Horticulture. 2005. DACO: M2.10.2
PMRA 1098419	Waiver requested for summary of Physical and Chemical Properties. Premier Horticulture. 2005. DACO: M2.12
PMRA 1098455	Manufacturing methods/process and quality assurance PRO-MIX BX with Biofungicide. Premier Horticulture. 2005. DACO: M2.8
PMRA 1098457	Count of active ingredient <i>Bacillus subtilis</i> MBI 600 instructions for PRO-MIX BX with Biofungicide. Premier Horticulture. 2005. DACO: M2.9.2
PMRA 1098458	Disclosure of Ingredients for PRO-MIX BX with Biofungicide. Premier Horticulture. 2005. DACO: M2.9.3
PMRA 1098450	Product Characterization and Analysis. Premier Horticulture. 2005. DACO: M2.1,M2.2,M2.3,M2.4,M2.5,M2.6
PMRA 1098451	Contaminants screening results for PRO-MIX BX with Biofungicide. Premier Horticulture. 2005. DACO: M2.10.2
PMRA 1098452	Analysis for Other Unintentional Ingredients for Pro-Mix BX with Biofungicide. Premier Horticulture. 2005. DACO: M2.10.3
PMRA 1098453	Storage stability results for PRO-MIX BX with Biofungicide. Premier Horticulture. 2005. DACO: M2.11
PMRA 1098454	Summary of Physical and Chemical Properties. Premier Horticulture. 2005. DACO: M2.12
PMRA 1098456	Product specifications form and formulants MSDS. Premier Horticulture. 2005. DACO: M2.9.1

PMRA 1098507	Product Characterization and Analysis table. Premier Horticulture. 2005. DACO: M2.1,M2.2,M2.3,M2.4,M2.5,M2.6
PMRA 1098508	Analysis for Other Unintentional Ingredients for Pro-Mix PGX with Biofungicide. Premier Horticulture. 2005. DACO: M2.10.3
PMRA 1098509	Storage stability results for PRO-MIX PGX with Biofungicide. Premier Horticulture. 2005. DACO: M2.11
PMRA 1098510	Waiver requested for summary of Physical and Chemical Properties. Premier Horticulture. 2005. DACO: M2.12
PMRA 1098511	Product specifications form and formulants MSDS. Premier Horticulture. 2005. DACO: M2.9.1
PMRA 1098552	Product Characterization and Analysis. Premier Horticulture. 2005. DACO: M2.1,M2.2,M2.3,M2.4,M2.5,M2.6
PMRA 1098553	Analysis for Other Unintentional Ingredients for Pro-Mix TA with Biofungicide. Premier Horticulture. 2005. DACO: M2.10.3
PMRA 1098554	Storage stability for PRO-MIX TA with Biofungicide. Premier Horticulture. 2005. DACO: M2.11
PMRA 1098555	Waiver requested for summary of Physical and Chemical Properties. Premier Horticulture. 2005. DACO: M2.12
PMRA 1098556	Product specifications form and formulants MSDS. Premier Horticulture. 2005. DACO: M2.9.1
PMRA 1099904	Analysis for Other Unintentional Ingredients for Pro-Mix TA with Biofungicide. Premier Horticulture. 2005. DACO: M2.10.2
PMRA 1100190	Analysis for Microbial Contaminants PRO MIX TA with Biofungicide. Premier Horticulture. 2005. DACO: M2.10.2

3.0 IMPACT ON HUMAN AND ANIMAL HEALTH

PMRA 1099726	Acute intravenous toxicity and infectivity/Pathogenicity to rats of MBI 600, Report No. 89398D/AGC 1/3/AC. 1989. DACO: M4.3.2
PMRA 1099727	Acute dermal toxicity of rabbits of MBI 600. Report No. 89270D/AGC 1/1/AC. 1989. DACO: M4.4,M4.5.2
PMRA 1099729	Delayed contact hypersensitivity in the Guinea-Pig with MBI 600. Report No. 89429D/AGC 2/SS. 1989. DACO: M4.6

PMRA 1099731	Primary eye irritation and infectivity of MBI 600. Report No . 89399D/AGC 1/4/SE. 1989. DACO: M4.9
PMRA 1099781	Acute oral toxicity and infectivity/Pathogenicity to rats of MBI 600 Technical. Report No. 89396D/AGC 1/0/AC. 1989. DACO: M4.2.2
PMRA 1099782	Acute pulmonary toxicity and infectivity/Pathogenicity to rats of MBI 600. Report No. 89397D/AGC 1/2/AC. 1989. DACO: M4.2.3
PMRA 1098428	Acute oral infectivity/pathogenicity and toxicity for PRO-MIX HP with Biofungicide. 2005. DACO: M4.2.2
PMRA 1098429	Acute pulmonary infectivity/pathogenicity and toxicity for PRO-MIX HP with Biofungicide. 2005. DACO: M4.2.3
PMRA 1098431	Intravenous infectivity for PRO-MIX HP with Biofungicide. 2005. DACO: M4.3.2
PMRA 1098432	Acute dermal toxicity for PRO-MIX HP with Biofungicide. 2005. DACO: M4.4
PMRA 1098434	Acute dermal irritation for PRO-MIX HP with Biofungicide. 2005. DACO: M4.5.2
PMRA 1098435	Reporting of hypersensitivity incidence for PRO-MIX HP with Biofungicide. 2005. DACO: M4.6
PMRA 1098483	Acute oral infectivity/pathogenicity and toxicity for PRO-MIX BX with Biofungicide. 2005. DACO: M4.2.2
PMRA 1098484	Acute pulmonary infectivity/pathogenicity and toxicity for PRO-MIX BX with Biofungicide. 2005. DACO: M4.2.3
PMRA 1098486	Intravenous infectivity for PRO-MIX BX with Biofungicide. 2005. DACO: M4.3.2
PMRA 1098487	2005, Acute dermal toxicity for PRO-MIX BX with biofungicide, S/O, MRID: S/O, DACO: M4.4
PMRA 1098489	Acute dermal irritation for PRO-MIX BX with Biofungicide. 2005. DACO: M4.5.2
PMRA 1098490	Reporting of hypersensitivity incidence for PRO-MIX BX with Biofungicide. 2005. DACO: M4.6

PMRA 1098529	Acute oral infectivity/pathogenicity and toxicity for PRO-MIX PGX with Biofungicide. 2005. DACO: M4.2.2
PMRA 1098530	Acute pulmonary infectivity/pathogenicity and toxicity for PRO-MIX PGX with Biofungicide. 2005. DACO: M4.2.3
PMRA 1098532	Intravenous infectivity for PRO-MIX PGX with Biofungicide. 2005. DACO: M4.3.2
PMRA 1098533	Acute dermal toxicity for PRO-MIX PGX with Biofungicide. 2005. DACO: M4.4
PMRA 1098535	Acute dermal irritation for PRO-MIX PGX with Biofungicide. 2005. DACO: M4.5.2
PMRA 1098536	Reporting of hypersensitivity incidence for PRO-MIX PGX with Biofungicide. 2005. DACO: M4.6
PMRA 1098574	Acute oral infectivity/pathogenicity and toxicity for PRO-MIX TA with Biofungicide. 2005. DACO: M4.2.2
PMRA 1098575	Acute pulmonary infectivity/pathogenicity and toxicity for PRO-MIX TA with Biofungicide. 2005. DACO: M4.2.3
PMRA 1098577	Intravenous infectivity for PRO-MIX TA with Biofungicide. 2005. DACO: M4.3.2
PMRA 1098578	Acute dermal toxicity for PRO-MIX TA with Biofungicide. 2005. DACO: M4.4
PMRA 1098580	Acute dermal irritation for PRO-MIX TA with Biofungicide. 2005. DACO: M4.5.2
PMRA 1098581	Reporting of hypersensitivity incidence for PRO-MIX TA with Biofungicide. 2005. DACO: M4.6

4.0 IMPACT ON THE ENVIRONMENT

PMRA 1099733	<i>Bacillus subtilis</i> Strain MBI 600: An Avian Oral Pathogenicity and Toxicity Study in the Bobwhite. Project No. 301-102. 1992. DACO: M9.2.1
PMRA 1099734	Toxicity Study of <i>Bacillus subtilis</i> MBI 600 on Carp (<i>Cyprinus carpio</i>). Study No. STS (2)-97004. 1997. DACO: M9.4.1

PMRA 1099735 Waiver Request for Estuarine and Marine Fish/Animal Study. 2005. DACO: M9.4.2

PMRA 1099736 Salinas, I., Cuesta, A., Ángeles Esteban, M., and Messeguer, J. 2005. Dietary administration of *Lactobacillus delbrueckii* and *Bacillus subtilis*, single or combined, on gilthead seabream cellular innate immune responses. *Fish Shellfish Immunol.* **19**:67–77. DACO: M9.4.2

PMRA 1099737 Waiver Request for Terrestrial Arthropods and the Honeybee Studies. 2005. DACO: M9.5.1

PMRA 1099738 Dedej, S., Delaplane, K. S., and Scherm, H. 2004. Effectiveness of honey bees in delivering the biocontrol agent *Bacillus subtilis* to blueberry flowers to suppress mummy berry disease. *Biol. Control* **31**:422–427. DACO: M9.5.1

PMRA 1099739 Arellano-Carbajal, F., and Olmos-Soto, J. 2002. Thermostable α -1,4- and α -1,6-glucosidase enzymes from *Bacillus* sp. isolated from a marine environment. *World J. Microbiol. Biotechnol.* **18**:791–795. DACO: M9.5.2

PMRA 1099740 Waiver Request for Aquatic Arthropod Study. 2005. DACO: M9.5.2

PMRA 1099741 Patnayak, S., and Sree, A. 2005. Screening of bacterial associates of marine sponges for single cell oil and PUFA. *Lett. Appl. Microbiol.* **40**:358–363. DACO: M9.5.2

PMRA 1099742 Vaseeharan, B., and Ramasamy, P. 2003. Control of pathogenic *Vibrio* spp. by *Bacillus subtilis* BT23, a possible probiotic treatment for black tiger shrimp *Penaeus monodon*. *Lett. Appl. Microbiol.* **36**:83–87. DACO: M9.5.2

PMRA 1099743 Ivanova, E. P., Vysotskii, M. V., Svetashev, V. I., Nedashkovskaya, O. I., Gorshkova, N. M., Mikailov, V. V., Yumoto, N., Shigeri, Y., Taguchi, and Yoshikawa, S. 1992. Characterization of *Bacillus* strains of marine origin. *Internat. Microbiol.* **2**:267–271. DACO: M9.5.2

PMRA 1099744 Liang, L. N., Sinclair, J. L., Mallory, L. M., and Alexander, M. 1982. Fate in model ecosystems of microbial species of potential use in genetic engineering. *Appl. Environ. Microbiol.* **44**:708–714. DACO: M9.5.2

PMRA 1099745	Waiver Request for Non-Arthropod Invertebrates Study. 2005. DACO: M9.6
PMRA 1099746	Garsin D. A., Sifri, C. D., Mylonakis, E., Qin, X., Singh, K. V., Murray, B. E., Calderwood, S. B., and Ausubel, F. M. 2001. A simple model host for identifying Gram-positive virulence factors. <i>Proc. Natl. Acad. Sci. U.S.A.</i> 98 :10892–10897. DACO: M9.6
PMRA 1099747	Hill, I. R., and Gray, T. R. G. 1967. Application of the fluorescent-antibody technique to an ecological study of bacteria in soil. <i>J. Bacteriol.</i> 93 :1888–1896. DACO: M9.6
PMRA 1099748	Evaluation of <i>Bacillus subtilis</i> MBI 600 (ATCC No. SD-1414) for its effect on soybeans (<i>Glycine Max</i>). Gustafson Biological Research Laboratory, Project No. 91417. 1991. DACO: M9.8.1
PMRA 1099749	Waiver Requested for Aquatic Plants Study. Premier Horticulture. 2005. DACO: M9.8.2
PMRA 1316478	Waiver Requested for Aquatic Plants Study. Premier Horticulture. 2005. DACO: M9.8.2
PMRA 1316471	Waiver Requested for Aquatic Plants Study. Premier Horticulture. 2005. DACO: M9.8.2
PMRA 1098438	Avian oral toxicity for PRO-MIX HP with Biofungicide. 2005. DACO: M9.2.1
PMRA 1098439	Freshwater fish for PRO-MIX HP with Biofungicide. 2005. DACO: M9.4.1
PMRA 1098440	Estuarine and marine fish/animal for PRO-MIX HP with Biofungicide. 2005. DACO: M9.4.2
PMRA 1098441	Terrestrial arthropods and honeybee for PRO-MIX HP with Biofungicide. 2005. DACO: M9.5.1
PMRA 1098442	Aquatic arthropods for PRO-MIX HP with Biofungicide. 2005. DACO: M9.5.2
PMRA 1098443	Non-arthropod invertebrates for PRO-MIX HP with Biofungicide. 2005. DACO: M9.6
PMRA 1098444	Terrestrial plants for PRO-MIX HP with Biofungicide. 2005. DACO: M9.8.1

PMRA 1098445	Waiver requested for aquatic plants study for PRO-MIX HP with Biofungicide. Premier Horticulture. 2005. DACO: M9.8.2
PMRA 1098493	Avian oral toxicity for PRO-MIX BX with Biofungicide. 2005. DACO: M9.2.1
PMRA 1098494	Freshwater fish for PRO-MIX BX with Biofungicide. 2005. DACO: M9.4.1
PMRA 1098495	Estuarine and marine fish/animal for PRO-MIX BX with Biofungicide. 2005. DACO: M9.4.2
PMRA 1098496	Terrestrial arthropods and honeybee for PRO-MIX BX with Biofungicide. 2005. DACO: M9.5.1
PMRA 1098497	Aquatic arthropods for PRO-MIX BX with Biofungicide. 2005. DACO: M9.5.2
PMRA 1098498	Non-arthropod invertebrates for PRO-MIX BX with Biofungicide. 2005. DACO: M9.6
PMRA 1098499	Terrestrial plants for PRO-MIX BX with Biofungicide. 2005. DACO: M9.8.1
PMRA 1098500	Waiver requested for aquatic plants study for PRO-MIX BX with Biofungicide. Premier Horticulture. 2005. DACO: M9.8.2
PMRA 1098539	Avian oral toxicity for PRO-MIX PGX with Biofungicide. 2005. DACO: M9.2.1
PMRA 1098540	Freshwater fish for PRO-MIX PGX with Biofungicide. 2005. DACO: M9.4.1
PMRA 1098541	Estuarine and marine fish/animal for PRO-MIX PGX with Biofungicide. 2005. DACO: M9.4.2
PMRA 1098542	Terrestrial arthropods and honeybee for PRO-MIX PGX with Biofungicide. 2005. DACO: M9.5.1
PMRA 1098543	Aquatic arthropods for PRO-MIX PGX with Biofungicide. 2005. DACO: M9.5.2
PMRA 1098544	Non-arthropod invertebrates for PRO-MIX PGX with Biofungicide. 2005. DACO: M9.6

PMRA 1098545	Terrestrial plants for PRO-MIX PGX with Biofungicide. 2005. DACO: M9.8.1
PMRA 1098546	Waiver requested for aquatic plants study for PRO-MIX PGX with Biofungicide. Premier Horticulture. 2005. DACO: M9.8.2
PMRA 1098584	Avian oral toxicity for PRO-MIX TA with Biofungicide. 2005. DACO: M9.2.1
PMRA 1098585	Freshwater fish for PRO-MIX TA with Biofungicide. 2005. DACO: M9.4.1
PMRA 1098586	Estuarine and marine fish/animal for PRO-MIX TA with Biofungicide. 2005. DACO: M9.4.2
PMRA 1098587	Terrestrial arthropods and honeybee for PRO-MIX TA with Biofungicide. 2005. DACO: M9.5.1
PMRA 1098588	Aquatic arthropods for PRO-MIX TA with Biofungicide. 2005. DACO: M9.5.2
PMRA1098589	Non-arthropod invertebrates for PRO-MIX TA with Biofungicide. 2005. DACO: M9.6
PMRA 1098590	Terrestrial plants for PRO-MIX TA with Biofungicide. 2005. DACO: M9.8.1
PMRA 1098591	Waiver requested for aquatic plants study for PRO-MIX TA with Biofungicide. Premier Horticulture. 2005. DACO: M9.8.2

5.0 VALUE

PMRA 1098459	Premier Horticulture, Canada. 2005. Summaries of the trials. pp. 8.
PMRA 1098460	2005. Efficacy of PRO-MIX with Subtilex against root rot disease caused by <i>Pythium ultimum</i> on sweet pepper. pp. 128.
PMRA 1098461	2005. Efficacy of PRO-MIX with Subtilex against damping-off disease caused by <i>Pythium ultimum</i> on tomatoes. pp. 134.
PMRA 1098462	2005. Efficacy of PRO-MIX with Subtilex against root rot disease caused by <i>Pythium ultimum</i> on cucumber. pp. 92.
PMRA 1098463	2005. Efficacy of PRO-MIX with Subtilex against root rot diseases caused by <i>Pythium ultimum</i> on celosia. pp. 130.

PMRA 1098464 2005. Efficacy of PRO-MIX with Subtilex against damping-off and root rot diseases caused by *Pythium aphanidermatum* on garden balsam. pp. 146.

PMRA 1098465 2005. Efficacy of PRO-MIX with Subtilex against black leg diseases caused by *Pythium ultimum* on geranium. pp. 122.

PMRA 1098466 2005. Phytotoxicity of PRO-MIX with Subtilex on sweet pepper. pp. 92.

PMRA 1098467 2005. Phytotoxicity of PRO-MIX with Subtilex on tomato. pp. 79.

PMRA 1098468 2005. Phytotoxicity of PRO-MIX with Subtilex on cucumber. pp. 83.

PMRA 1098469 2005. Phytotoxicity of PRO-MIX with Subtilex on garden balsam. pp. 79.

PMRA 1098470 2005. Phytotoxicity of PRO-MIX with Subtilex on celosia. pp. 78.

PMRA 1098471 2005. Phytotoxicity of PRO-MIX with Subtilex on geranium. pp. 78.

PMRA 1098473 Letter from Becker Underwood regarding tank-mixing of Subtilex (*Bacillus subtilis* strain MBI 600) with chemical fungicides. pp. 6.

PMRA 1098476 Contribution to integrated pest management strategies and practices. pp. 4.

PMRA 1098411 Waiver requested for Pro-Mix HP with Biofungicide efficacy results. Premier Horticulture. pp. 47.

PMRA 1098513 Waiver requested for Pro-Mix PGX with Biofungicide efficacy results. Premier Horticulture. pp. 54.

PMRA 1098558 Waiver requested for Pro-Mix TA with Biofungicide efficacy results. Premier Horticulture. pp. 54.

B. ADDITIONAL INFORMATION CONSIDERED**i) Published Information****2.0 METHODS OF ANALYSIS**

PMRA 1326535 Banerjee, P. C. 1977. Lytic effects of mycobacillin and its derivatives on erythrocytes. *Antimicrob. Agents Chemother.* **12**:124–125.

PMRA 1326536 De Lucca, A. J., and Walsh, T. J. 2000. Antifungal peptides: Origin, activity and therapeutic potential. *Rev. Iberoam. Micol.* **17**:116–120.

PMRA 1326537 Katz, E., and Demain, A. L. 1977. The peptide antibiotics of *Bacillus*: Chemistry, biogenesis, and possible functions. *Bacteriol. Rev.* **41**:449–474.

PMRA 1326538 Leclère, V., Béchet, M., Adam, A., Guez, J.-S., Wathelet, B., Ongena, M., Thonart, P., Gancel, F., Chollet-Imbert, M., and Jacques, P. 2005. Mycosubtilin overproduction by *Bacillus subtilis* BBG100 enhances the organisms' antagonistic and biocontrol activities. *Appl. Environ. Microbiol.* **71**:4577–4584.

PMRA 1326539 Rodrigues, L., Banat, I. M., Teixeira, J., and Oliveira, R. 2006. Biosurfactants: Potential applications in medicine. *J. Antimicrob. Chemother.* **57**:609–618.

